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3050

B.C.A. Examination, 2016
Fourth Semester
Fifth Paper
(Mathematics-III)

Time : Three Hours

Maximum Marks : 75

Note : Attempt any **five** questions. All questions carry equal marks.

1. (a) Express the complex number

$$z = 2 + 2\sqrt{3}i \text{ in polar form.}$$

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- (b) Find the square roots of $-15 - 8i$.

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- (c) If $z_1 = r_1(\cos\theta_1 + i \sin\theta_1)$,

$z_2 = r_2(\cos\theta_2 + i \sin\theta_2)$, then prove that

$$z_1 z_2 = r_1 r_2 \{ \cos(\theta_1 + \theta_2) + i \sin(\theta_1 + \theta_2) \}.$$

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2. (a) Define a sequence of real numbers. Show that every convergent sequence is bounded.

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- (b) Show that the alternating series

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$$1 - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} + \dots \text{ is convergent.}$$

- (c) Test the convergence of the series:

$$x + \frac{2^2 x^2}{2!} + \frac{3^3 x^3}{3!} + \frac{4^4 x^4}{4!} + \dots$$

3. (a) Define curl of a vector point function

$\mathbf{F} = F_1 \hat{i} + F_2 \hat{j} + F_3 \hat{k}$. Find the curl of the vector $\mathbf{f} = xyz \hat{i} + 3x^2y \hat{j} + (xz^2 - y^2z) \hat{k}$.

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- (b) Find the directional derivative of $\frac{1}{r}$ in

the direction of \vec{r} where

$$\vec{r} = x \hat{i} + y \hat{j} + z \hat{k}.$$

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4. (a) Describe even and odd functions with examples.

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- (b) Obtain the Fourier series of the periodic function defined as:

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$$f(x) = \begin{cases} -\pi & ; 0 < x < \pi \\ x - \pi & ; \pi < x < 2\pi \end{cases}$$

5. (a) Solve the differential equation: 8

$$x(x-1)\frac{dy}{dx} - (x-2)y = x^2(2x-1)$$

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(b) Solve by variable separable method. 7

$$(x+1)\frac{dy}{dx} = x(y^2 + 1)$$

6. (a) Obtain the complete solution of 7

$$\frac{d^2y}{dx^2} + 6\frac{dy}{dx} + 9y = 5e^{3x}$$

(b) Solve the equation- 8

$$\frac{d^2y}{dx^2} - 2\frac{dy}{dx} + y = x \cdot \sin x$$

7. (a) Solve the homogeneous differential

equation - MGKVPonline.com 8

$$x^2 dy + y(x+y) dx = 0$$

(b) Define the gradient of a scalar field and
divergence of a vector field. 7